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## IN SUPPORT OF GARDNER'S THEORY OF THE ORIGIN OF CERTAIN CONCRETIONS<sup>1</sup>

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In an article in the *Journal of Geology*, Gardner<sup>2</sup> has maintained that certain concretions are formed in supersaturated or overloaded water carrying fine clay particles. He believes that the particles are pressed together and are gathered in lumps just as the finely disseminated particles of butter are gathered together in churning and that these particles grow by accretion and gain their spherical form by being rolled along the bottom. He bases his opinion on observations of aggregations of mud balls in the bed of a stream after a flood in the Rio Chaco region of the San Juan Basin, New Mexico.

In the summer of 1921 the writer observed similar phenomena in the bed of the North Fork of the Red River, Beckham County, Oklahoma. As a result of a series of severe rains, this river, which is usually an insignificant stream flowing in sand-choked channels, had been flowing bank full. After the flood had subsided the writer observed on one of the sandy flats in the river bed a remarkable collection of clay aggregations similar to those described by Gardner. They consisted both of clay balls and cylinders, the former being much more numerous. The balls varied from less than an inch to about six inches in diameter. The cylinders were from four to six inches in diameter and a foot or more in length. Both balls and cylinders were composed of fine clay, with a small amount of sand and gravel in them or imbedded in the outer portion. The cylinders were apparently the result of two balls becoming stuck together and being rolled along the bottom, as several cases were observed showing the steps in this process. The considerable

<sup>1</sup> Published by permission of the Director of the Oklahoma Geological Survey.

<sup>2</sup> J. H. Gardner, "Physical Origin of Certain Concretions," *Jour. Geol.*, Vol. XVI (1908), pp. 442-58.

number of these aggregations at the place described seemed to be due to the fact that the flat was on the inside of a rather sharp bend where the current would be slackened.



FIG. 1.—Concretionary-like aggregations of fine clay deposited on a sandy flat in the bed of the North Fork of the Red River, Oklahoma, during a flood.

From the very perfect resemblance of these clay aggregations to ordinary concretions and the rather large number of them found after this one flood, the writer is inclined to agree with Gardner that this method of formation of concretions may be more common than is ordinarily supposed.

Figure 1 gives some idea of their size and distribution.